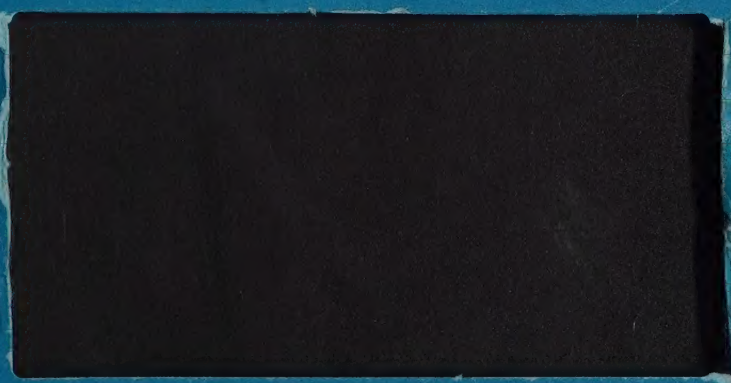
INSTRUCTION MANUAL

REGULATED POWER SUPPLIES



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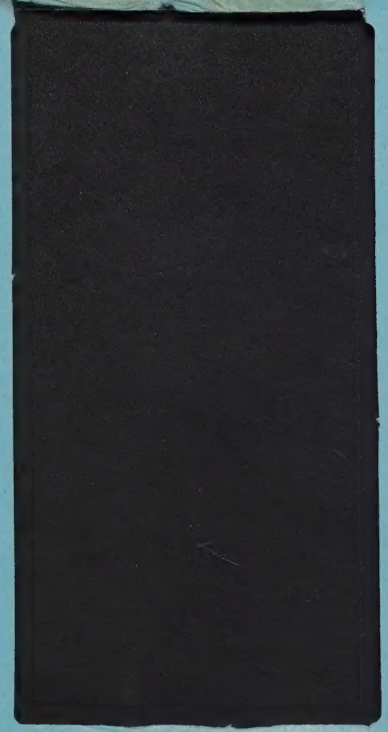

INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

MODEL

LXS-7 SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics Corp. All information contained herein applies to all LXS-7 model sunless otherwise specified.

LAMBDA ELECTRONICS CORP. MELVILLE, L.I., N.Y.
MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

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DC OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I
VOLTAGE AND CURRENT RANGES

MODELS	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE			
		40°C	50°C	60°C	71°C
LXS-7-5-OV	5 ± 5%	65.0	56.0	46.0	35.0
LXS-7-6-OV	6 ± 5%	59.0	50.0	41.0	32.0
LXS-7-12-OV	12 ± 5%	40.0	36.0	30.0	23.0
LXS-7-15-OV	15 ±5%	36.0	32.0	26.0	20.0
LXS-7-20-OV	20 ± 5%	28.0	25.0	20.5	15.0
LXS-7-24-OV	24 ± 5%	25.0	22.0	18.0	14.0
LXS-7-28-OV	28 ± 5%	22.0	19.5	16.0	12.5

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT

Regulation ..... 0.1% line or load with input variations from 105-132 or 132-105 volts AC and load variations from no load to full load or full load to no load.

Ripple and Noise ..... 1.5 millivolts rms; 5 millivolts peak to peak with either positive or negative terminal grounded.

Temperature Coefficient ..... Output change in voltage 0.03%/°C.

Remote Programming

External Resistor ..... Nominal 1000 ohms/volt output change.

Programming Voltage ..... One-to-one voltage change.

Remote Sensing ..... Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 105-132 VAC at 47-440 Hz. Input Power: 1300 Watts.* Ratings apply for 57-63 Hz. For operation at other than 57-63 Hz, consult factory.

* With output loaded to full current rating and input voltage 132 volts AC, 60 Hz.

INPUT FUSE — 20 ampere fuse F1 protects the AC input circuit. Overload of the supply does not cause fuse failure.

OVERLOAD PROTECTION

Thermal	Thermostat, resets automatically when over temperature condition is eliminated.
Electrical	
External	Automatic electronic current limiting circuit, limits output current to a preset safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — All LXS-7 models include a built-in overvoltage protection circuit which prevents damage to the load caused by excessive power supply output voltage.

INPUT CONNECTIONS — Terminal block on rear of chassis.

OUTPUT CONNECTIONS — ¼ x 28 studs on rear of chassis.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 71°C ambient.

STORAGE TEMPERATURE (non operating) — -55°C to 85°C

CONTROLS

VDC Adjust Control	Voltage adjust control permits adjustment of DC output.
Overvoltage Control	OV ADJ. control permits setting the overvoltage protection point.
Power	Panel-mounted magnetic circuit breaker. Overvoltage condition causes breaker to trip.

PHYSICAL DATA

Size	4-15/16" x 10-1/8" x 16-1/2"
Weight	48 lbs. net; 60 lbs. shipping wt.
Finish	Gray, FED. STD. 595 No. 26081

MOUNTING — One surface with tapped mounting holes can be utilized for mounting this unit. Refer to figure 10 for mounting details. All LXS-7 power supplies must be mounted with top facing up and in a horizontal plane.

SUFFIX "R" — All LXS-7 power supplies with suffix "R" are fungus inert.

"J" OPTION — All LXS-7 power supplies can be obtained for 90-110 VAC INPUT. For operation at 47-53 Hz delete the 40°C current rating. For operation at 63-440 Hz, consult factory.

"V" OPTION — All LXS-7 power supplies can be obtained for 205-265 VAC INPUT or 187-242 VAC INPUT. See nameplate for AC INPUT rating. See schematic diagram for rewiring of AC INPUT. For operation at 47-53 Hz delete the 40°C current rating. For operation at 63-440 Hz consult factory.

ACCESSORIES

Rack adapters	Rack adapter LRA-11 used for ruggedized mounting with or without chassis slides is available.

THEORY OF OPERATION

The Lambda power supply consists of an AC input circuit and transformer; a bias supply consisting of an auxiliary rectifier and filter; and a main regulator circuit consisting of the main rectifier, filter, series regulator transistors, and Hybrid Voltage Regulator. The Hybrid Voltage Regulator (HC1) utilizes thick-film resistors, capacitors, monolithic integrated circuits and power driver transistors in chip form to achieve maximum reliability. The circuit arrangement is shown in block diagram form, Figure 8.

Single phase input power is applied to transformer T1 through terminals 1 and 2.

The main rectifier, a full wave rectifier, provides the power which is filtered by capacitors C1-C4 and then regulated via series regulators Q6-Q17. Auxiliary rectifiers CR9, CR10 and/or as applicable CR4, CR7 provide voltage filtered by capacitor C9 for regulator control circuits located in HC1.

OV CIRCUIT, FUNCTIONAL DESCRIPTION

Divider network OV-R1, OV-R2, OV-R3, OV-R4 and OV-R7 attenuates the power supply output voltage. When the power supply output voltage increases above the overvoltage limit set by OV ADJ. control OV-R1, the attenuated voltage of the divider network also increases, biasing transistor OV-Q1 on. OV-Q1, in turn, biases OV-Q2 on through resistor OV-R10. OV-Q2 supplies gate current to OV-SCR1, turning it on, driving current through the circuit breaker trip coil and into the gate of SCR1, turning SCR1 on. This, in turn, causes the voltage at the power supply terminals to drop; protecting the load from excessive supply output voltage. OV-SCR1 and SCR1 conduct until the circuit breaker trips, causing power to the power supply to be cut off.

CAUTION

The overvoltage protector will not provide protection against overvoltage conditions caused by storage batteries or other power sources used in conjunction with the Lambda power supply. Whenever additional power sources must be used with the Lambda power supply and overvoltage protection is incorporated, consult the factory for proper installation information.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When rated load current is exceeded, both voltage and current decrease until voltage reaches zero and the current at short circuit is reduced to a safe value, which is less than the 40°C current rating.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block and power studs on the rear of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) lead to terminal 1.

The supply positive terminal is brought out to terminal 6. The supply negative terminal is brought out to terminal 4. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 7. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the rear output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. The local sensing connection is the connection suitable for applications with relatively constant load.

Remote Sensing Connection, Figure 4. The remote sensing connection provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at a nominal 1000 ohms/volt change and a shorting-type switch as shown in figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will nominally be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply if the output voltage control of the programmed supply is set to minimum output voltage. Output voltage of programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 1.1 ma. minimum.

Alternatively, when supplies with less than 1.1 ma. reverse current capability are used, a resistor capable of drawing 1.1 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections for Series Operation, Figure 7.

The voltage capability of LXS-7 power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I of SPECIFICATIONS AND FEATURES for power supply current and voltage ratings.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermal Shutdown

The thermostat opens the input circuit only when the temperature of the internal heat sink exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Overvoltage Shutdown

When the power supply output voltage increases above the overvoltage limit, SCR1 will short circuit output of the supply and circuit breaker CB1 will trip opening the input circuit. After eliminating the cause(s) for overvoltage, resume operation of the supply by placing circuit breaker in ON position.

Circuit Breaker Shutdown

If a malfunction occurs in the power supply causing an overvoltage condition, CB1 will open the input circuit. If CB1 trips, check for cause and repair as necessary. To resume operation, place CB1 in ON position.

Fuse Shutdown

Fuses will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

MAINTENANCE

GENERAL

This section describes trouble analysis routine and replacement procedures that are useful for servicing the Lambda LXS-7 power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on SPECIFICATIONS AND FEATURES for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumper and supply-load connections.

Use the electrical schematic diagram and block diagram, figure 8, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an instrument that has a highly limited current capability. Observe proper polarity to avoid error in measurement. The forward transistor resistance is low but never zero; backward resistance is always higher than the forward resistance.

For good transistors, the forward resistance for any junction is always greater than zero.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on before checking for additional defective components could damage the replaced component.

When soldering semi-conductor devices, wherever possible, hold the lead being soldered with a pair of pliers placed between the component and the solder joint to provide an effective heat sink.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

a) AC power of proper voltage and frequency is present at input terminals.

b) Either positive or negative terminal is connected to chassis ground.

c) The power supply is connected for constant voltage with local sensing. See schematic; dotted lines indicate jumpers connected for local sensing operation.

TROUBLE SHOOTING CHART

Symptom	Probable Cause	Remedy
1. Zero volts DC output	Short circuit across output of supply	Check load and load connections, correct as necessary.
	Open CB1.	Refer to "Symptoms 3, 4, 5, and 6."
	Thermostat, S1 open.	Refer to table I of SPECIFICATIONS AND FEATURES for current ratings at given ambient temperature. After allowing time for the power supply to cool, resume operation of power supply.
	R5 open, Q5 shorted.	Check R5 for open, Q5 for short; replace as necessary.
	Series regulator section open.	Check HC1 pin for correct voltage reading (as indicated on schematic diagram).
	Current sensing resistor open.	Check R19-R24 for open, replace as necessary.
	Auxiliary rectifiers CR9 CR10, and/or as applicable CR4, CR7 open.	Check CR9, CR10, CR4, CR7 for open; replace as necessary.
2. Unable to adjust output voltage.	Damaged VDC adjust control.	Check R1 for short or open, replace as necessary.
	R2 set too low.	Refer to ADJUSTMENT OF CALIBRATION CONTROL R2.
3. High ripple at line frequency or twice line frequency and unregulated DC output.	Series regulator section shorted	Check Q6, Q17 for short; replace as necessary.
	C9 open.	Check C9 for open; replace as required.

4. Same as 3, except intermittent	Foreign matter fallen into unit.	Check for loose bench hardware and wire clippings that may have fallen through cover.
5. Large spikes at output.	Defective rectifiers CR1, CR2, CR3, CR15.	Replace as required.
6. Output voltage too high.	R1 set too high; open sensing lead.	Check setting of R1; check output connections.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 9. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a VTVM, Ballantine 320 or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R2

Whenever Q6-Q17, HC1, R19-R24, or R2 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R2 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating.

1. Remove AC input power to the supply.
2. Break seal on wiper of R2 from resistor housing and turn to full CW position.
3. Operate power supply for constant voltage with local sensing, connected as shown in figure 3, with no external load.
4. Turn voltage adjust control until minimum rated output voltage is obtained.
5. Apply load so that output current is 140% of 40° rating for the unit.
6. Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R2 in CCW direction. Adjust R2 until output ripple increases sharply and oscilloscope pattern changes.
7. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R2 to resistor housing.
8. After sealing, check setting and repeat adjustment procedure if required.

ADJUSTMENT OF OV ADJ CONTROL OV-R1

Adjust the voltage-protection point of overvoltage protector circuit as follows:

1. Turn OV ADJ control on front panel fully clockwise.

2. The recommended voltage-protection point is 115% of normal power supply operation voltage plus one volt. Compute this value for the operation voltage being used.

3. Turn on the power supply, and raise the output voltage to the desired voltage-protection point; monitor the power supply output voltage to assure correct voltage. If the power supply does not have an adequate adjustment range omit steps 4 and 5, and continue with step 6 below.

4. Slowly turn the OV ADJ control counterclockwise until the circuit breaker trips, indicating that the voltage protection point is reached.

5. The voltage-protection point is now set. Reduce power supply output voltage setting before re-applying input power.

6. If the power supply output voltage adjustment range does not extend to the protection-point voltage computed in step 2, proceed as follows:

   a) Turn on power supply and raise output voltage to the normal operating voltage.

   b) Slowly turn the OV ADJ control counterclockwise until the circuit breaker trips.

   c) Refer to chart below, select appropriate volts/turn ratio, and turn OV ADJ control clockwise by the number of turns equivalent to 1 volt plus 15% of the operating voltage.

MODEL	VOLTS/TURN	OVERVOLTAGE ADJUSTMENT RANGE
LXS-7-5-OV, 6-OV	0.3	3 - 8v
LXS-7-12-OV, 15-OV	0.8	6 - 20v
LXS-7-20-OV, 24-OV, 28-OV	2.7	18 - 40v

For Example:

When using power supply LXS-7-5-OV with output voltage setting of 5 volts, calculate as follows:

$$T = \frac{1+.15\,(OV)}{V/T}$$

where

T=turns of OV ADJ control

OV=operating voltage of power supply

V/T=volts/turn ratio from chart

$$T=\frac{1+.15(5)}{0.3}=5.8$$

Rotate OV ADJ control 5.8 turns in clockwise direction to obtain a voltage setting 1.8 volts above the 5-volt power supply setting, or 6.8 volts.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description, function, and location, of the part.

PARTS LIST

The electrical parts located on Lambda models LXS-7-5-OV — LCS-7-28-OV are listed here. Parts common to a group of models are listed first. Unique parts of individual models within the group are listed separately, by model, immediately following the group common-parts listing. In addition, there is a separate listing of parts for the "J" and "V" options.

COMMON PARTS
MODELS LXS-7-5-OV AND LXS-7-6-OV

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C1 thru C4	Cap., elect., 60,000 mf -10+100%, 15 vdc	CBT-60-036	$10.50
C5, C6	Not assigned		
C7	Cap., elect., 3.3 mf ±20%, 35 vdc	CBN-33-019	1.35
C8	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009	.50
C9	Cap., elect., 3,500 mf -10+100%, 15 vdc	CBS-35-079	2.65
C10, C11	Not assigned		
C12	Cap., elect., 40 mf -10+75%, 33 vdc	CBP-40-036	1.20
C13	Cap., mylar, 0.1 mf ±10%, 200 vdc	CAM-10-012	.65
C14	Cap., elect., 7,500 mf -10+100%, 15 vdc	CBS-75-077	4.50
C15	Cap., mylar, 0.01 mf ±10%, 200 vdc	CGL-10-002	.36
C16 thru C22	Not assigned		
C23	Cap., mylar, 470 pf ±10%, 200 vdc	CGJ-47-002	.33
CB1	Circuit breaker	FHC-01-001-2	13.50
CR1 thru CR3	Rectifier	FBL-00-083	2.75
CR4	Rectifier	FBL-00-030	1.40
CR5 thru CR8	Not assigned		
CR9, CR10	Rectifier	FBL-00-054	1.50
CR11 thru CR14	Not assigned		
CR15	Same as CR1		
F1	Fuse, 20A	FFP-20-000	2.25
HC1	Hybrid regulator	FBH-24-023	50.00
Q1 thru Q4	Not assigned		
Q5	Transistor, NPN	FBN-L110	3.25
Q6 thru Q17	Transistor, NPN	FBN-36972	6.30
R1	Res., var., ww, 2,200 ohms ±5%, 2 w	DNS-22-053	2.50
R2	Res., var., ww, 3,000 ohms ±10%, 1½ w	DNS-30-101	2.00
R3, R4	Not assigned		

COMMON PARTS (Cont.)
MODELS LXS-7-5-OV AND LXS-7-6-OV (Cont.)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R5	Res., comp., 1,000 ohms ±10%, ½ w	DEB-1021	$ .12
R6	Not assigned		
R7	Res., comp., 560 ohms ±10%, ½ w	DEB-5611	.12
R8, R9	Not assigned		
R10	Res., comp., 15 ohms ±10%, ½ w	DEB-1501	.12
R11, R12	Not assigned		
R13	Res., ww, 0.125 ohm ±5%, 3 w	DFM-13-036	1.00
R14	Same as R5		
R15 thru R18	Not assigned		
R19 thru R24	Res., center tapped, ww, 0.2 ohm ±5%, 22w	DFM-20-054	2.75
R25	Not assigned		
R26	Res., ww, 3 ohms ±3%, 3 w	DFN-30-023	.59
R27	Res., comp., 3.3 ohms ±10%, ½ w	DEB-33G1	.12
S1	Thermostat	FKA-155-020	2.85
SCR1	Rectifier, silicon controlled	FBP-00-010	15.00
XF1	Fuseholder	HRM-00-013	2.75
	Overvoltage Sub-assembly	LMOV-1F	

UNIQUE PARTS
MODEL LXS-7-5-OV

T1	Transformer	ABA-LXS7-5	87.00

MODEL LXS-7-6-OV

T1	Transformer	ABA-LXS7-6	87.00

COMMON PARTS
MODELS LXS-7-12-OV AND LXS-7-15-OV

C1 thru C4	Cap., elect., 26,000 mf -10+100%, 30 vdc	CBT-26-031	11.75
C5	Not assigned		
C6	Cap., mylar, 0.1 mf ±10%, 200 vdc	CAM-10-012	.65
C7	Cap., elect., 3.3 mf ±20%, 35 vdc	CBN-33-019	1.35
C8	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009	.50

COMMON PARTS (Cont.)
MODELS LXS-7-12-OV AND LXS-7-15-OV (Cont.)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C9	Cap., elect., 1,200 mf -10+100%, 50 vdc	CBS-12-082	$ 2.52
C10, C11	Not assigned		
C12	Cap., mylar, 470 pf ±10%, 200 vdc	CGJ-47-002	.33
C13	Same as C6		
C14	Cap., elect., 5,100 mf -10+100%, 30 vdc	CBS-51-088	7.00
C15 thru C22	Not assigned		
C23	Cap., elect., 1 mf ±20%, 35 vdc	CBN-10-009	1.33
CB1	Circuit breaker	FHC-01-001-2	13.50
CR1 thru CR3	Rectifier	FBL-00-083	2.75
CR4	Rectifier	FBL-00-094	.99
CR5	Not assigned		
CR6	Rectifier, zener diode	FBM-Z143	1.00
CR7	Same as CR4		
CR8 thru CR14	Not assigned		
CR15	Same as CR1		
F1	Fuse, 20A	FFP-20-000	2.25
HC1	Hybrid regulator	FBH-24-035	50.00
Q1 thru Q4	Not assigned		
Q5	Transistor, NPN	FBN-L110	3.25
Q6 thru Q17	Transistor, NPN	FBN-36972	6.30
R1	Res., var., ww, 3,300 ohms ±5%, 2 w	DNS-33-054	2.50
R2	Res., var., ww, 3,000 ±10%, 1½ w	DNS-30-101	2.00
R3, R4	Not assigned		
R5	Res., comp., 470 ohms ±10%, ½ w	DEB-4711	.12
R6	Not assigned		
R7	Res., ww, 1,200 ohms ±3%, 3 w	DFS-12-016	.93
R8, R9	Not assigned		
R10	Res., comp., 15 ohms ±10%, ½ w	DEB-1501	.12
R11, R12	Not assigned		
R13	Res., ww, 0.208 ohm ±5%, 3 w	DFM-21-030	1.00
R14	Res., comp., 1,000 ohms ±10%, ½ w	DEB-1021	.12
R15 thru R17	Not assigned		
R19 thru R24	Res., center tapped, ww, 0.36 ohm ±5%, 22 w	DFM-36-049	1.75
R25	Not assigned		
R26	Res., ww, 3 ohms ±3%, 3 w	DFN-30-023	.59

COMMON PARTS (Cont.)
MODELS LXS-7-12-OV AND LXS-7-15-OV (Cont.)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R27	Res., comp., 3.3 ohms ±10%, ½ w	DEB-33G1	$ .12
R28	Res., ww, 10 ohms ±3%, 3 w	DFP-10-030	.60
S1	Thermostat	FKA-155-020	2.85
SCR1	Rectifier, silicon controlled	FBP-00-010	15.00
XF1	Fuseholder	HRM-00-013	2.75
	Overvoltage Sub-assembly	LMOV-2F	

UNIQUE PARTS
MODEL LXS-7-12-OV

R18	Not assigned		
T1	Transformer	ABA-LXS7-12	87.00

MODEL LXS-7-15-OV

R18	Res., film, 2,700 ohms ±5%, ½ w	DCS-27-020	.25
T1	Transformer	ABA-LXS7-15	87.00

COMMON PARTS
MODELS LXS-7-20-OV — LCS-7-28-OV

C1 thru C4	Cap., elect., 17,000 mf -10+100%, 50 vdc	CBT-17-022	12.39
C5	Not assigned		
C6	Cap., mylar, 0.1 mf ±10%, 200 vdc	CAM-10-012	.65
C7	Cap., elect., 2.2 mf ±20%, 50 vdc	CBN-22-007	2.94
C8	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009	.50
C9	Cap., elect., 1,200 mf -10+100%, 50 vdc	CBS-12-082	2.52
C10	Not assigned		
C13	Same as C6		
C14	Cap., elect., 2,700 mf -10+100%, 50 vdc	CBS-27-089	3.60
C15	Not assigned		
C18	Cap., mica, 680 pf ±10%, 300 vdc	CCJ-68-006	.50
C19 thru C22	Not assigned		
C23	Cap., elect., 1 mf ±20%, 35 vdc	CBN-10-009	1.33
C24 thru C29	Not assigned		
CB1	Circuit breaker	FHC-01-001-2	13.50
CR1 thru CR3	Rectifier	FBL-00-083	2.75
CR4	Rectifier	FBL-00-094	.99
CR5	Rectifier (located within Overvoltage Sub-assembly)	FBM-Z144	1.00
CR6	Rectifier, zener diode	FBM-Z143	1.00
CR7	Same as CR4		
CR8 thru CR14	Not assigned		

COMMON PARTS (Cont.)
MODELS LXS-7-20-OV — LXS-7-28-OV (Cont.)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
CR15	Same as CR1		
F1	Fuse, 20A	FFP-20-000	$ 2.25
HC1	Hybrid regulator	FBH-24-036	50.00
Q1 thru Q4	Not assigned		
Q5	Transistor, NPN	FBN-L110	3.25
Q6 thru Q17	Transistor, NPN	FBN-38022	7.65
R2	Res., var., ww, 1,200 ohms ±10%, 1½ w	DNS-12-087	1.37
R3, R4	Not assigned		
R5	Res., ww, 1,200 ohms ±3%, 3 w	DFS-12-016	.93
R6	Not assigned		
R7	Res., ww, 1,800 ohms ±3%, 3 w	DFS-18-048	.60
R8, R9	Not assigned		
R10	Res., comp., 27 ohms ±5%, ½ w	DEB-2705	.24
R11, R12	Not assigned		
R13	Res., ww, 0.3 ohm ±5%, 3 w	DFM-30-053	.50
R14	Res., comp., 1,000 ohms ±10%, ½ w	DEB-1021	.12
R15 thru R17	Not assigned		
R19 thru R24	Res., center tapped, ww, 0.6 ohm ±5%, 22 w	DFM-60-050	1.50
R25	Not assigned		
R26	Res., ww, 3 ohms ±3%, 3 w	DFN-30-023	.59
R27	Res., comp., 3.3 ohms ±10%, ½ w	DEB-33G1	.12
R28	Res., ww, 18 ohms ±3%, 3 w	DFP-18-034	.50
R29	Not assigned		
R30	Res.., ww, 1,500 ohms ±3%, 3 w	DFS-15-045	.70
S1	Thermostat	FKA-155-020	2.85
SCR1	Rectifier, silicon controlled	FBP-00-010	15.00
XF1	Fuseholder	HRM-00-013	2.75
	Overvoltage Sub-assembly	LMOV-3F	

UNIQUE PARTS
MODEL LXS-7-20-OV

C11	Not assigned		
C12	Cap., mylar, 470 pf ±10%, 200 vdc	CGJ-47-002	.33
C16, C17	Not assigned		
C30	Cap., elect., 10 mf -10+50%, 50 vdc	CBP-10-078	1.20
R1	Res., var., ww, 4,500 ±5%, 2 w	DNS-45-059	2.50
R18	Not assigned		
T1	Transformer	ABA-LXS7-20	87.00

UNIQUE PARTS (Cont.)
MODEL LXS-7-24-OV

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C11	Cap., mylar, 0.01 mf ±20%, 80 vdc	CGL-10-008	$ .50
C12	Not assigned		
C16	Cap., mylar, 0.047 mf ±10%, 400 vdc	CGL-47-018	.39
C17	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009	.50
C30	Not assigned		
R1	Res., var., ww, 9,000 ohms ±5%, 2 w	DNS-90-051	2.50
R18	Not assigned		
T1	Transformer	ABA-LXS7-24	87.00

MODEL LXS-7-28-OV

C11	Cap., mylar, 0.01 mf ±20%, 80 vdc	CGL-10-008	.50
C12	Not assigned		
C16	Cap., mylar, 0.047 mf ±10%, 400 vdc	CGL-47-018	.39
C17	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009	.50
C30	Not assigned		
R1	Res., var., ww, 9,000 ohms ±5%, 2 w	DNS-90-051	2.50
R18	Res., film, 5,100 ohms ±5%, ½ w	DCS-51-002	.25
T1	Transformer	ABA-LXS7-28	87.00

PARTS FOR OVERVOLTAGE SUB-ASSEMBLY MODELS LMOV-1F, LMOV-2F, LMOV-3F

COMMON PARTS

C1	Cap., mylar, 0.01 mf ±20%, 80 vdc	CGL-10-008	.50
Q1	Transistor, NPN	FBN-L102	2.40
R3	Res., film, 200 ohms ±5%, ½ w	DCR-20-010	.20
R4	Res., thermistor, 425 ohms ±5%, 1¼ w	DKR-43-004	1.52
R5, R6	Res., comp., 1,200 ohms ±10%, ½ w	DEB-1221	.12
R8	Res., comp., 1,5000 ohms ±10%, ½ w	DEB-1531	.12
R10	Same as R5		
SCR1	Rectifier, silicon controlled	FBP-00-009	5.00

UNIQUE PARTS
MODEL LMOV-1F

Q2	Transistor, PNP	FBN-L103	1.76
R1	Res., var., ww, 2,000 ohms ±10%, 1 w	DNS-20-034	3.00
R2	Res., film, 560 ohms ±2%, ½ w	DCR-56-002	.65
R7	Res., comp., 33 ohms ±5%, ¼ w	DCB-3305	.15
R9	Res., comp., 22 ohms ±10%, ½ w	DEB-2201	.12

MODEL LMOV-2F

Q2	Transistor, PNP	FBN-L103	1.76
R1	Res., var., ww, 5,000 ohms ±10%, 1 w	DNS-50-036	3.15
R2	Res., film, 1,470 ohms ±1%, ½ w	DCS-15-031	.30
R7	Res., comp., 33 ohms ±5%, ¼ w	DCB-3305	.15
R9	Res., comp., 68 ohms ±10%, ½ w	DEB-6801	.12

UNIQUE PARTS (Cont.)
MODEL LMOV-3F

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
Q2	Transistor, PNP	FBN-L114	$ 3.50
R1	Res., var., ww, 20,000 ohms ±10%, 1 w	DNT-20-010	3.25
R2	Res., film, 4,700 ohms ±2%, ½ w	DCS-47-028	.30
R7	Res., comp., 39 ohms ±5%, ¼ w	DCB-3905	.15
R9	Res., comp., 220 ohms ±10%, ½ w	DEB-2211	.12

PARTS FOR SUFFIX "R"

On all LXS-7 models with suffix "R", resistor R1 changes. Part no. changes for R1 are listed here.

	MODELS LXS-7-5-OV AND LXS-7-6-OV		
R1	Res., var., ww, 2,200 ohms ±5%, 2 w	DNS-22-070	6.25
	MODELS LXS-7-12-OV AND LXS-7-15-OV		
R1	Res., var., ww, 3,300 ohms ±5%, 2 w	DNS-33-071	6.25
	MODEL LXS-7-20-OV		
R1	Res., var., ww, 4,500 ohms ±5%, 2 w	DNS-45-072	6.25
	MODELS LXS-7-24-OV AND LXS-7-28-OV		
R1	Res., var., ww, 9,000 ohms ±5%, 2 w	DNS-90-073	6.25

PARTS FOR "J" OPTION

On all LXS-7 models with suffix "J", transformer T1 changes. For transformer T1 used on these models, see standard LXS-7 model parts list for standard transformer part no. and add suffix "J" to the part no. Price for T1 does not change.

PARTS FOR "V" OPTION

On all LXS-7 models with suffix "V", capacitor C8, circuit breaker CB1, fuse F1, and transformer T1 change. Part no. changes for C8, CB1, and F1 are listed here. For transformer T1 used on these models, see standard LXS-7 model parts list for standard transformer part no. and add suffix "G" to the part no. Price for T1 does not change.

ALL MODELS

C8	Cap., paper, 0.01 mf ±10%, 1000 vdc	CAL-10-021	$1.77
CB1	Circuit breaker	FHE-01-001-2	
F1	Fuse, 10A	FFP-10-000	2.40

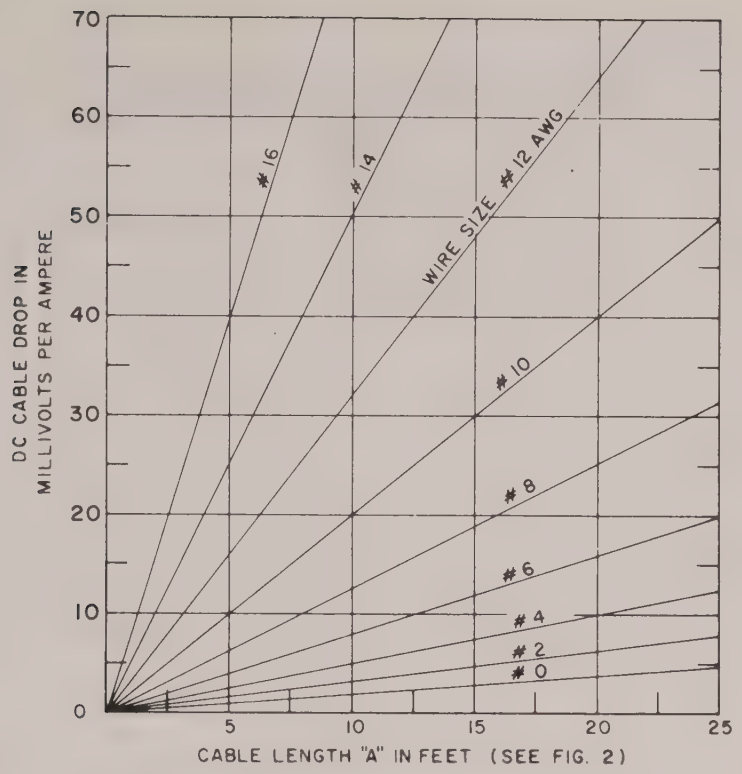


Figure 1. Cable Connection Chart

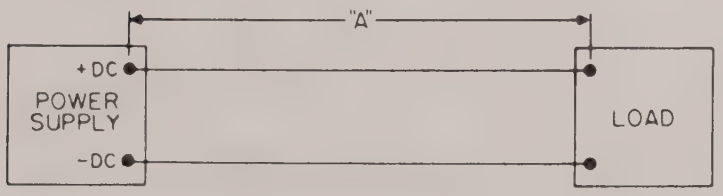


Figure 2. Cable Length "A" in Feet

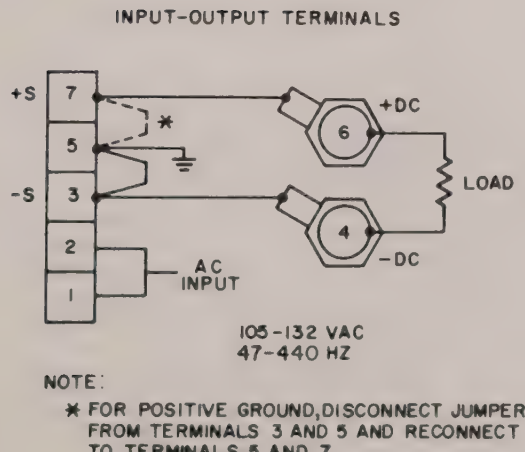


Figure 3. Local Sensing Connection.

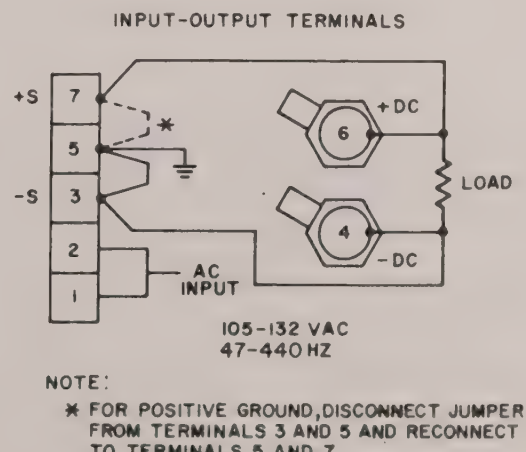


Figure 4. Remote Sensing Connection.

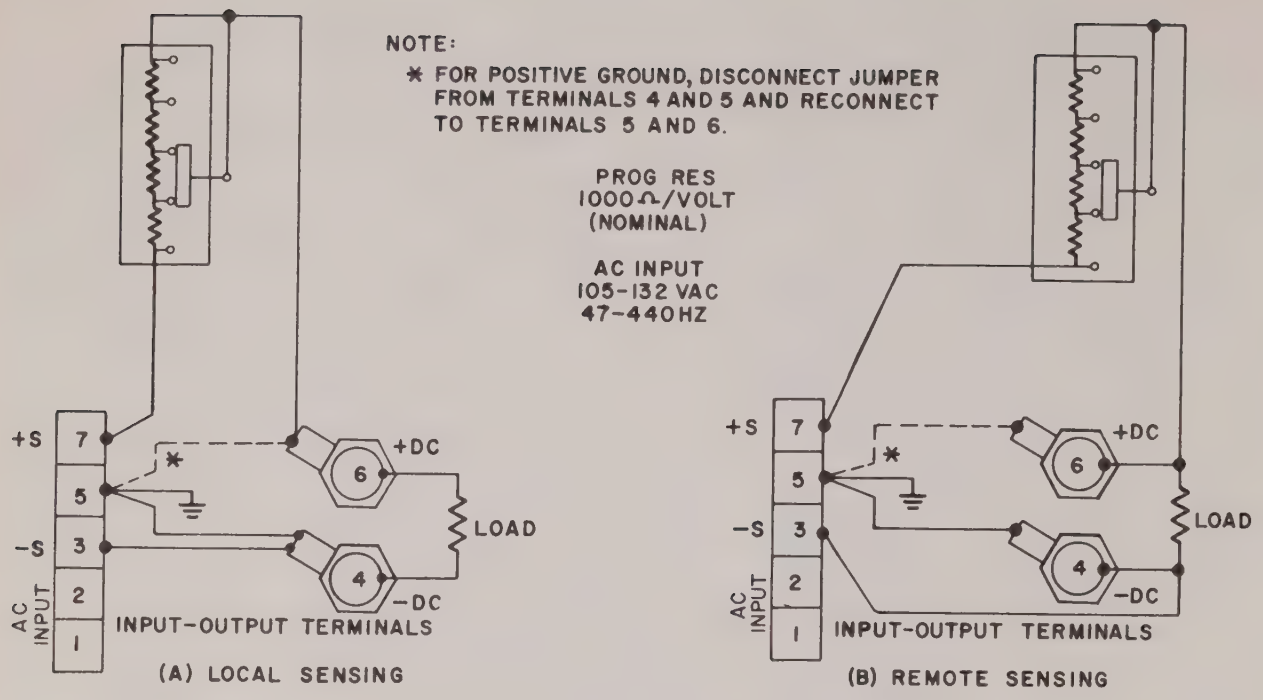


Figure 5. Programmed Voltage, With External Resistor

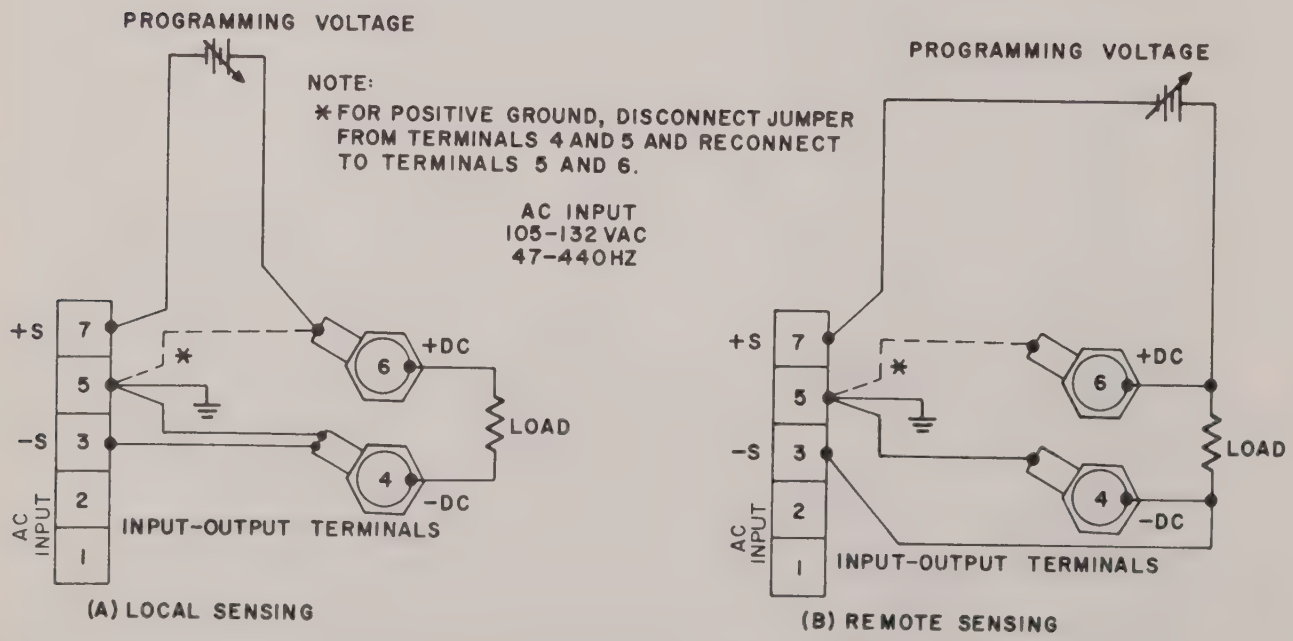
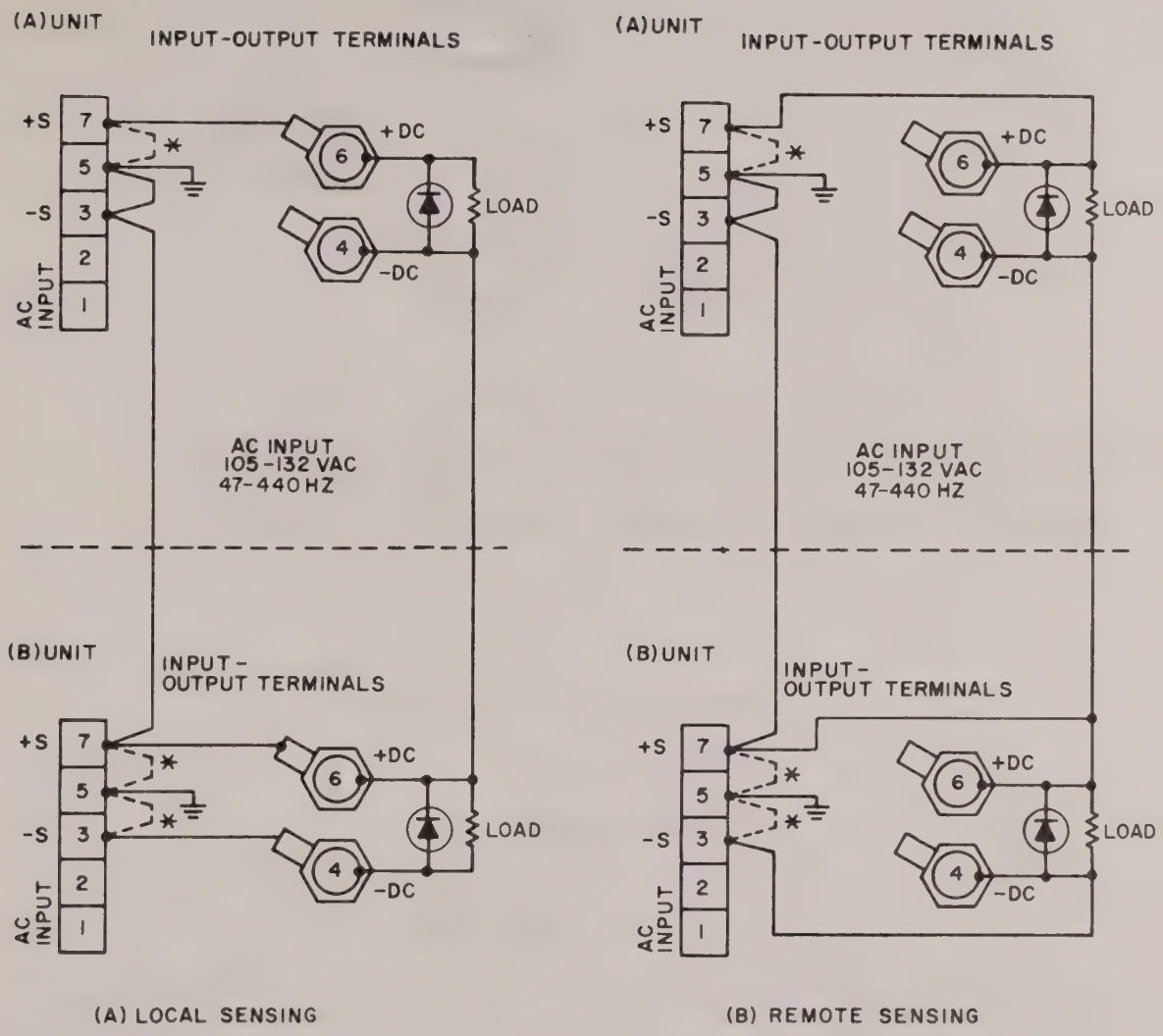


Figure 6. Programmed Voltage With External Programming Voltage Source



NOTE:

* MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS 5 AND 3 ON (A) UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE.

Figure 7. Series Connection

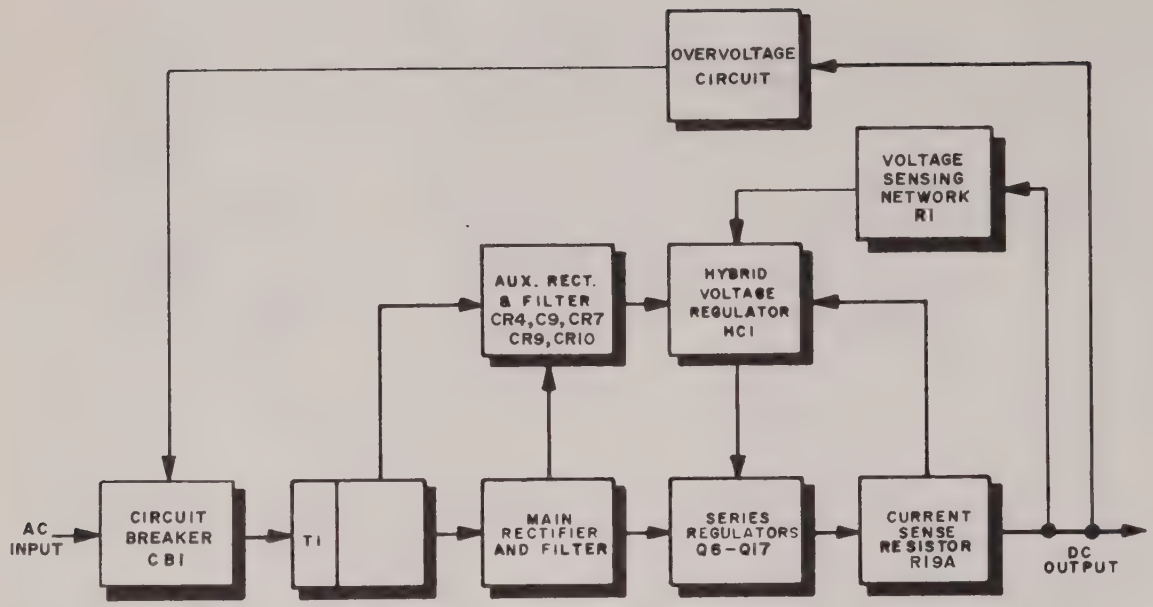
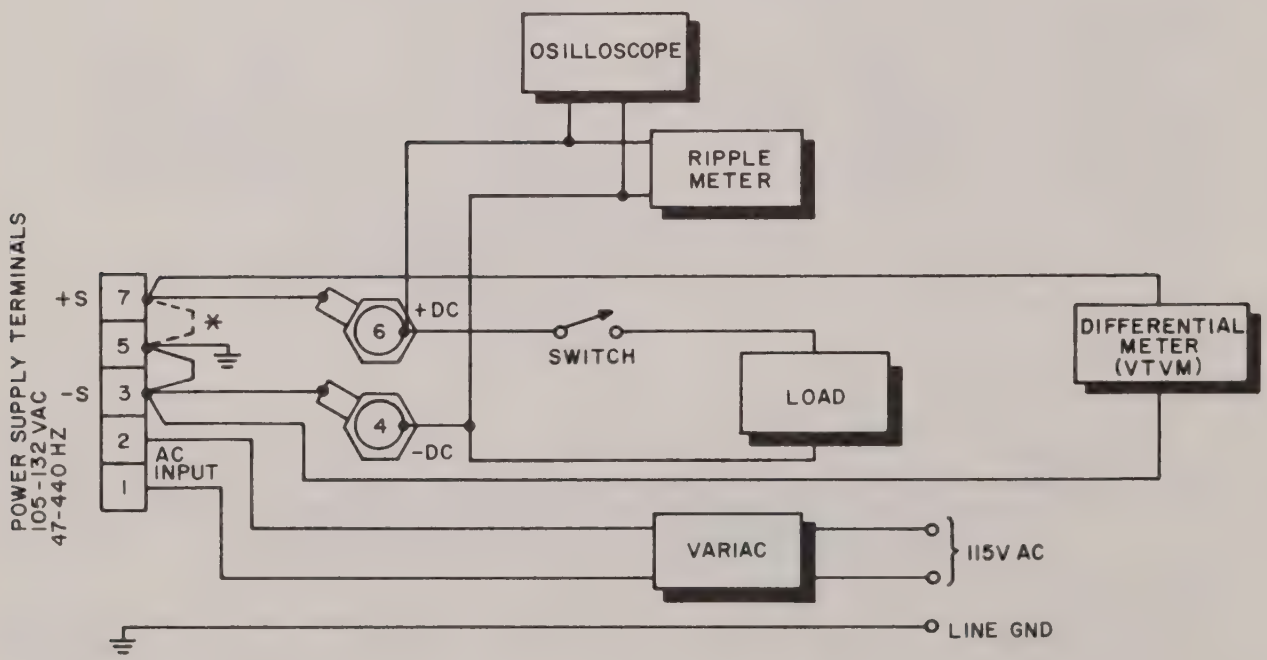


Figure 8. Typical Block Diagram



NOTES:
1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.

Figure 9. Test Connections for Performance Checks

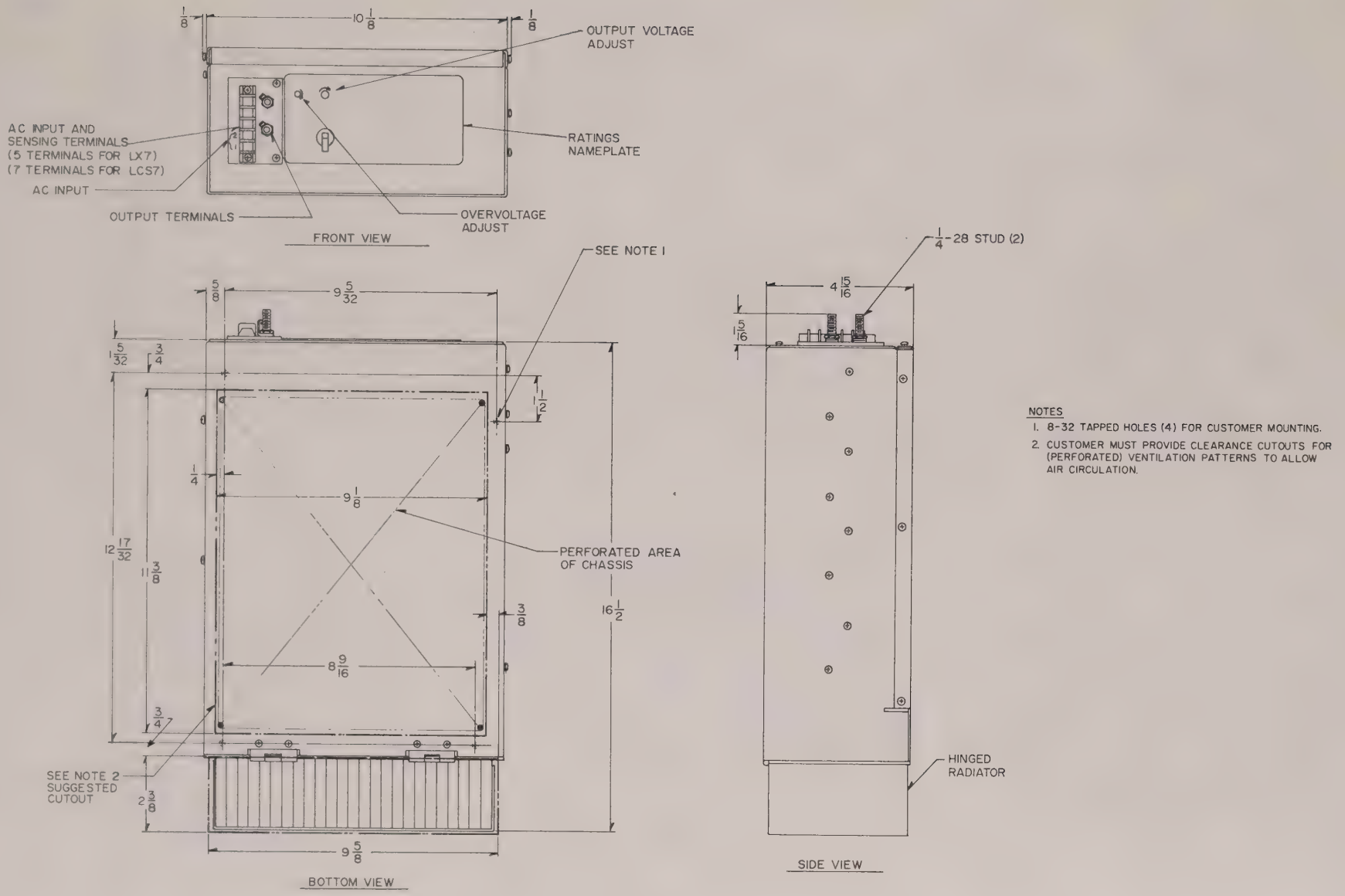
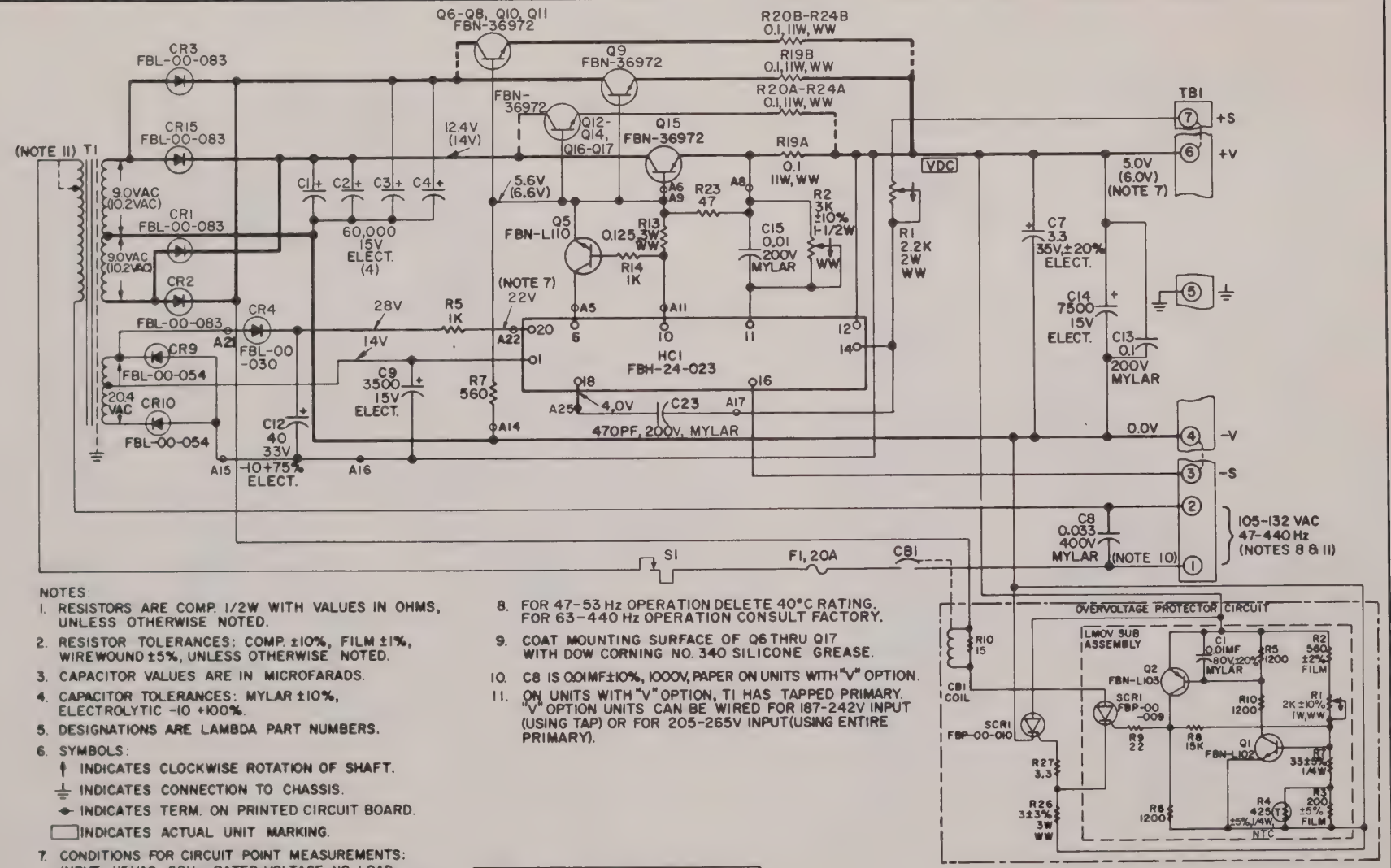

OUTPUT VOLTAGE ADJUST
AC INPUT AND SENSING TERMINALS (5 TERMINALS FOR LX7) (7 TERMINALS FOR LCS7)
AC INPUT
OUTPUT TERMINALS
RATINGS NAMEPLATE
OVERVOLTAGE ADJUST
FRONT VIEW
SEE NOTE 1
PERFORATED AREA OF CHASSIS
SEE NOTE 2 SUGGESTED CUTOUT
BOTTOM VIEW
1/4-28 STUD (2)
HINGED RADIATOR
SIDE VIEW
NOTES
1. 8-32 TAPPED HOLES (4) FOR CUSTOMER MOUNTING.
2. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR (PERFORATED) VENTILATION PATTERNS TO ALLOW AIR CIRCULATION.

Figure 10. Outline Drawing.



NOTES:

1. RESISTORS ARE COMP. 1/2W WITH VALUES IN OHMS, UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: COMP. ±10%, FILM ±1%, WIREWOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: MYLAR ±10%, ELECTROLYTIC -10 +100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES TERM. ON PRINTED CIRCUIT BOARD.
   - INDICATES ACTUAL UNIT MARKING.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT. 115 VAC, 60Hz. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE D.C. UNLESS OTHERWISE NOTED, D.C. MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN -V (TERM.4) AND INDICATED POINTS UNLESS OTHERWISE NOTED. VOLTAGES IN PARENTHESIS APPLY ONLY TO MODEL LXS-7-6-0V. A SINGLE READING APPLIES TO BOTH MODELS.
8. FOR 47-53 Hz OPERATION DELETE 40°C RATING. FOR 63-440 Hz OPERATION CONSULT FACTORY.
9. COAT MOUNTING SURFACE OF Q6 THRU Q17 WITH DOW CORNING NO. 340 SILICONE GREASE.
10. C8 IS 0.01MF±10%, 1000V, PAPER ON UNITS WITH "V" OPTION.
11. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY).

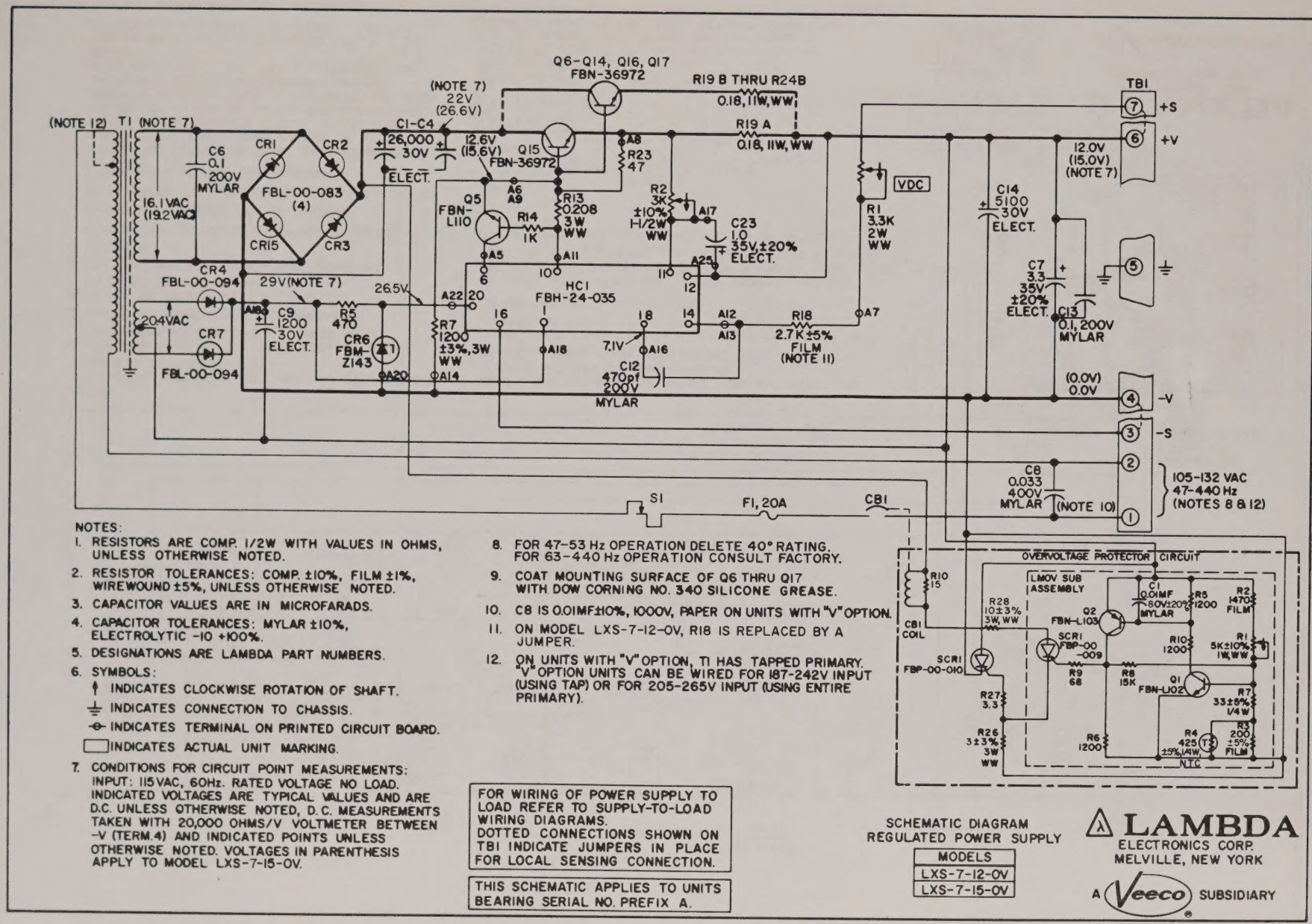
FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS. DOTTED CONNECTIONS SHOWN ON TBI INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A.

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODELS
LXS-7-5-0V
LXS-7-6-0V

LAMBDA
ELECTRONICS CORP.
MELVILLE, NEW YORK
A Veeco SUBSIDIARY



NOTES:

1. RESISTORS ARE COMP. 1/2W WITH VALUES IN OHMS, UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: COMP. ±10%, FILM ±1%, WIREWOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: MYLAR ±10%, ELECTROLYTIC -10 +100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - ↑ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ⏚ INDICATES CONNECTION TO CHASSIS.
   - -o- INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
   - ▭ INDICATES ACTUAL UNIT MARKING.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE D.C. UNLESS OTHERWISE NOTED, D.C. MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN -V (TERM.4) AND INDICATED POINTS UNLESS OTHERWISE NOTED. VOLTAGES IN PARENTHESIS APPLY TO MODEL LXS-7-15-0V.
8. FOR 47-53 Hz OPERATION DELETE 40° RATING. FOR 63-440 Hz OPERATION CONSULT FACTORY.
9. COAT MOUNTING SURFACE OF Q6 THRU Q17 WITH DOW CORNING NO. 340 SILICONE GREASE.
10. C8 IS 0.01MF±10%, 1000V, PAPER ON UNITS WITH "V" OPTION.
11. ON MODEL LXS-7-12-0V, R18 IS REPLACED BY A JUMPER.
12. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY).

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS. DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A.

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODELS
LXS-7-12-0V
LXS-7-15-0V

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ELECTRONICS CORP.
MELVILLE, NEW YORK
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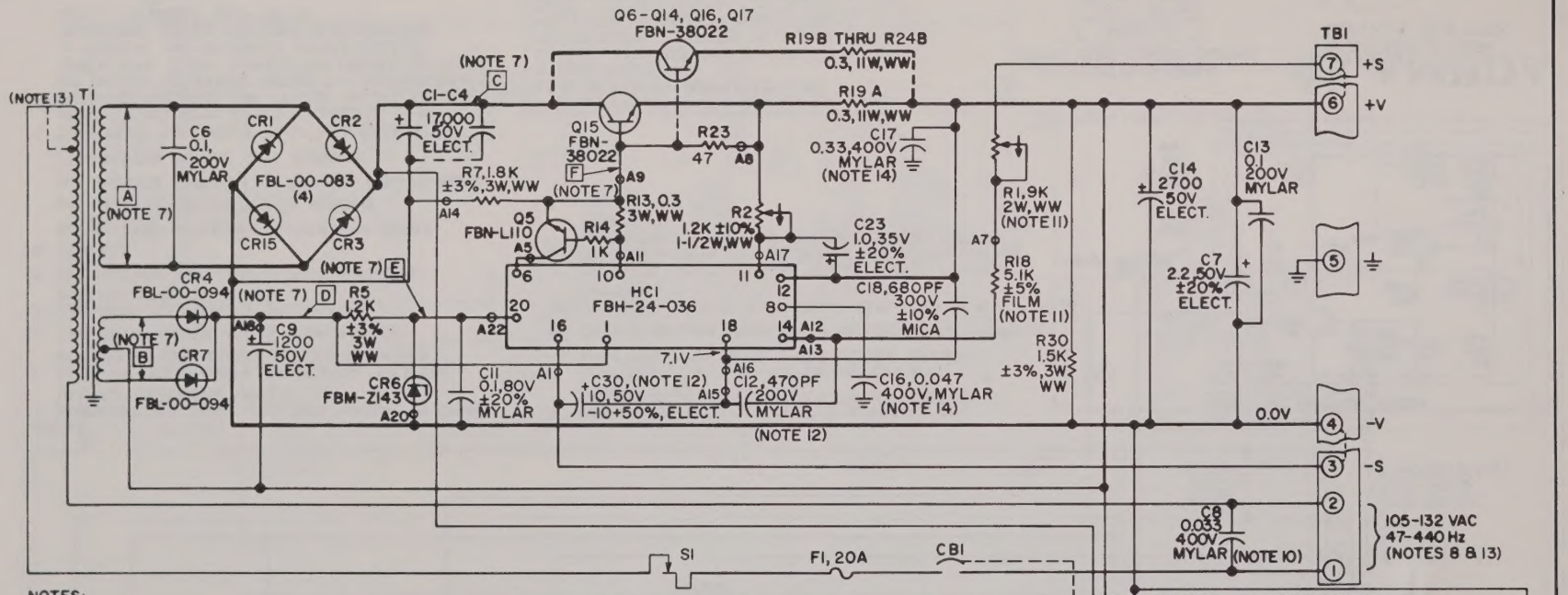


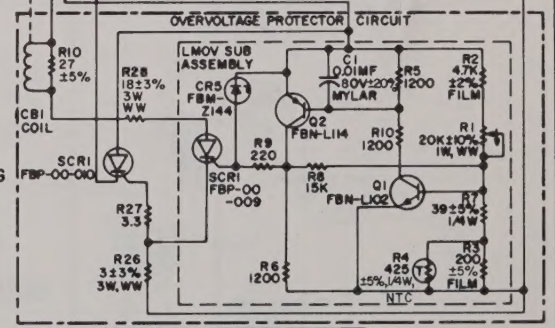
NOTES:

1. RESISTORS ARE COMP. 1/2W WITH VALUES IN OHMS, UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: COMP. ±10%, FILM ±1%, WIREWOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: MYLAR ±10%, ELECTROLYTIC -10 +100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - ↑ - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ⏚ INDICATES CONNECTION TO CHASSIS.
   - ⊖ INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
   - ▭ INDICATES ACTUAL UNIT MARKING.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz.. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE D.C. UNLESS OTHERWISE NOTED, D.C. MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN -V (TERM.4) AND INDICATED POINTS UNLESS OTHERWISE NOTED. SEE TABLE I FOR VOLTAGE VALUES.
8. FOR 47-53 Hz OPERATION DELETE 40°C RATING. FOR 63-440 Hz OPERATION CONSULT FACTORY.
9. COAT MOUNTING SURFACE OF Q6 THRU Q17 WITH DOW CORNING NO. 340 SILICONE GREASE.
10. C8 IS 0.01 MF ±10%, 1000V, PAPER ON UNITS WITH "V" OPTION.
11. ON MODELS LXS-7-20-0V AND LXS-7-24-0V, R18 IS A JUMPER. ON MODEL LXS-7-20, R1 IS 4.5K.
12. C12 AND C30 ONLY USED ON MODEL LXS-7-20-0V.
13. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY).
14. C11, C16, AND C17 NOT USED ON MODEL LXS-7-20-0V.

TABLE I
SCHEMATIC VOLTAGE VALUES

MODEL	A (VAC)	B (VAC)	C (VDC)	D (VDC)	E (VDC)	F (VDC)
LXS-7-20-0V	21.4	20.4	30.0	47.5	36.0	20.6
LXS-7-24-0V	28.1	20.4	39.5	51.5	36.0	24.6
LXS-7-28-0V	30.6	20.4	43.8	55.5	36.0	28.6

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS. DOTTED CONNECTIONS SHOWN ON TBI INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.



THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A.

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODELS
LXS-7-20-0V
LXS-7-24-0V
LXS-7-28-0V

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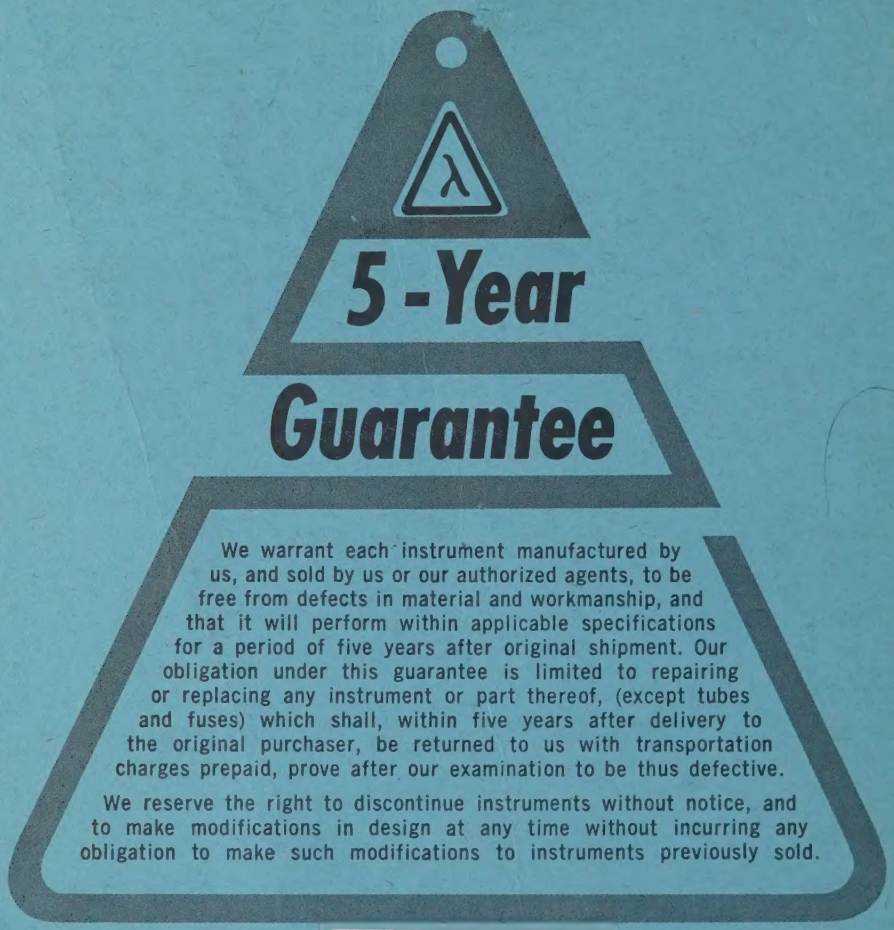
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Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
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